

# **“The Future of EV and PHEV Infrastructure”**



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New Hampshire Clean Cities Stakeholder Meeting

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# Presentation Outline

- The Past
- The Present
- The Future
- How can we get there from here?

# The Past



# Lessons Learned

- Electric Vehicles Work!
  - Toyota Rav4s, Ford Rangers, Solectria Forces, Solectria Citivans still on the road
  - EVermont study demonstrated successful performance & reliability in cold weather
- Competing charging technologies (conductive vs inductive) halved effectiveness and doubled costs for public infrastructure
- Unique equipment and warranty requirements required specialized contractor training
- Much higher utilization for workplace EVSE than for public stations
- Public confusion about EVs' limitations impeded market acceptance

Adapted from Bill Boyce, 2009: "Electric Vehicle Infrastructure: Market History and Observations."

<http://www.arb.ca.gov/msprog/zevprog/infrastructure/infrastructure.htm>; and Harold Garabedian, 2009: "EVermont – the Vermont Electric Vehicle Demonstration Project.

# Lessons Learned pt 2

- High fixed costs made for difficult business case
- Market never developed to sustain the business
- Repair cost coverage needs to be factored into business model
- Free public charging inhibited cost recovery from sector that happened to require the most maintenance
- Strategic, targeted infrastructure deployments to avoid dashed hopes and stranded investments
- Don't put the cart before the horse!

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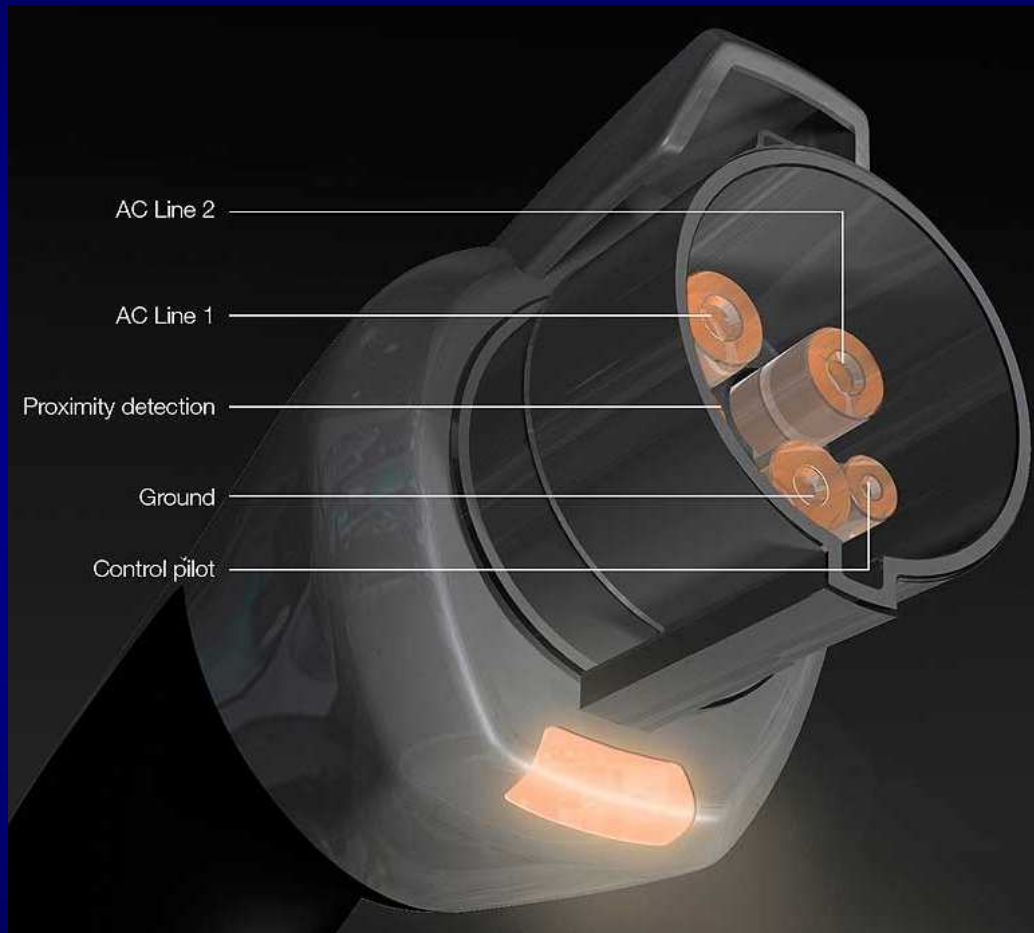
# The Present?



# The Present

- SAE J1772 connector standard finalized January 2010
  - Covers Level 1 and Level 2 Charging
  - Level 3 still under development
- Chargers available but cost still high (\$3k - \$5k for residential Level 2)
- Several OEMs planning limited commercial deployments in 2010 and 2011
- ZEV
- Pavley/CAFE

# SAE J1772



- Final approval January 2010
- Level 1:
  - 120VAC, 16A
- Level 2:
  - 208/240 VAC, <80A
- Level 3 under development:
  - 300-600V DC
  - 150-400A proposed



# The Future?



Source: [www.evoasis.com](http://www.evoasis.com)

# The Future:

- Diverse offerings of both BEV and PHEV
- Comfort level among consumers, dealers, EVSE vendors and permitting officials
- Mature, built-out network of charging stations
- Economies of scale lead to low-cost chargers (\$200 - \$400 for residential Level-2)
- SAE Standard for fast charge (Level-3)
- ZEV 2.0?
- Pavley 2?
- Low-Carbon Fuel Standard?

# The Future:

- Smart grid
- Battery-swap stations
- V2H / V2G
- Roadside inductive charging
- ???

- These technologies could be beneficial but are NOT required for EV / PHEV commercialization!!

# How Can We Get There From Here?

## “Wish List”:

### Policy Support for EV Market & Infrastructure

- Vehicle Incentives
- Permitting challenges
- Electricity pricing

### Commercial maturity for home-based EVSE

- Purchase and install like any other appliance
- Retail price <\$500 (currently >\$3,000)

Vehicles must be available...

...and public fleets, businesses, and individual consumers must buy them!!

# Where should the chargers be?

## Charging Infrastructure

- Residential – majority of units
  - Seamless installations for homeowners
  - Permits, electricians, inspections
  - Rates and
- Workplace or Retail
  - Commercial/Industrial customers
- Public Charging
  - Support municipalities





# Strategic Infrastructure Deployment: “Nodes to Networks”



Source: Catherine Dunwoody, 2009. "Hydrogen Fuel Cell Vehicles and Stations: Moving toward an early market <http://www.arb.ca.gov/msprog/zevprog/2009symposium/presentations/dunwoody.pdf>

# Project Get Ready “Must Haves”

1. Fleets commit to buy vehicles
2. Early registration / money down for interested buyers
3. Collaborative stakeholder group to coordinate parties, develop plan and garner commitments
4. Designate “champion” to keep effort moving
5. Work with banks to offer low-interest loans
6. Bundle key incentives at vehicle point of purchase
7. Perks for EV drivers: HOV, toll roads, parking
8. Educate community with test drives and “quick” leases
9. Reduced electricity rates for EV charging
10. Fast-track permitting for EVSE
11. New building codes should require EVSE compatibility
12. Time-of-use charging
13. Local businesses provide EVSE
14. Install public charging in high-traffic zones
15. Affordable (or free) purchase and installation of home chargers

<http://projectgetready.com/>

# How Do We Get There From Here?

## Key Challenges:

- Timetables for vehicle rollouts remain uncertain
- Robust incentives to enhance market response
- Consumer behavior largely untested
  - How many miles?
  - How strong a preference for electric-only operation?
  - How willing to change habits (e.g. night-time & opportunity charging)
- Public charging network more costly in rural areas



# How Do We Get There From Here?

## The Good News:

- Plug-in Hybrid Electric Vehicles!
- Fleet turnover will occur gradually
- With careful planning and a conservative deployment strategy, infrastructure can grow as needed to support existing fleets and drivers
- There is no “Chicken/Egg” problem – the vehicle must come first!



# Where do we go from here?

- It's important to be ready, but vehicles must come first
- Early vehicle placements will be PHEVs or BEVs in homes that can accommodate home-based charging
- Workplace and strategic public installations can follow in high-traffic locations that are frequented by specific fleets or early adopters
- As consumer preferences are better understood, infrastructure can be more effectively deployed
- PHEVs can facilitate “organic” growth of EVSE networks by providing flexibility to early adopters while the market adapts to their preferences



# Let's Go!!

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